



OFFICE OF WASTE TECHNICAL SUPPORT

M TO: ACL Table Users
E FROM: Sanjay Thirunagari
M DATE: October 26, 2006
O SUBJECT: Technical memorandum detailing the use of
Alternate Concentration Limits for Establishing
Groundwater Protection Standards (GPS)

Attached, please find the revised alternate concentration limits (ACL) technical memorandum along with the ACL table. Any facility that intends to establish the risk-based ACL is required to **submit a variance petition that meets the requirements of section 9.3 of the VSWMR**. The attached table is provided for information purposes and should not be used for facilities that do not meet the assumptions provided in Appendix II. Please let me know if you have any questions or suggestions regarding this technical memorandum.

DRAFT
TECHNICAL MEMORANDUM TO CALCULATE HEALTH BASED ALTERNATE
CONCENTRATION
LIMIT USING REAMS FOR A SOLID WASTE FACILITY

Revised September 28, 2006

Applicability

The following technical memorandum is provided to establish a risk based Groundwater Protection Standard (GWPS) for sanitary landfills in accordance with 9VAC 20-80-250.D.6.h & i of the 9VAC 20-80-10. The technical memorandum addresses some of the key issues for establishing the GWPS. The technical memorandum has two appendices. Appendix I provides the methodology to calculate site specific alternate concentration limits (ACL) using the REAMS Windows program. Appendix II has a table of risk based concentrations for groundwater that may be used as ACLs, provided the groundwater use at the site is the same as the assumptions identified within Appendix II. For the purpose of establishing alternate concentration limits, **the facility must submit a variance petition** which meets the requirements of the 9VAC 20-80-760 of the 9VAC 20-80-10. The petition must address all items of 9VAC 20-80-760.

At a minimum, the following shall be considered to evaluate the petition:

I. Point of Compliance (POC)

POC is the vertical surface at the waste management unit boundary that extends into the upper most aquifer. However, in accordance with 9VAC 20-80-770, if the variance to location of the groundwater monitoring system is approved by the Director, the POC may be established at a maximum distance of 500 feet from the waste disposal boundary in the groundwater flow direction. Per the approved variance (9VAC 20-80-770), the downgradient monitoring wells must be installed and monitored at the point of compliance (POC). The GWPS are set at the downgradient monitoring wells.

Point of exposure (POE) is the point at which it is assumed a potential receptor can come in contact, either now or in the future, with the contaminated groundwater (EPA, 1987). To develop the risk based ACL, if the concentration at the POE and the point of compliance are the same, no fate and transport modeling of the contaminants is allowed beyond the POC. However, if the facility demonstrates that the POE is not the same as the POC, the facility may use fate and transport modeling to determine the ACL at the POC. For the purpose of modeling, the POE shall not exceed beyond the facility boundary or any other current receptor on site. The calculated ACL must be protective of human health and the environment at the POE.

II Use of MCL as GWPS

In accordance with 9VAC 20-80-250.D.6.h (1), if the facility has detected contaminants for

which a maximum contaminant level (MCL) have been promulgated under Section 1412 of the Safe Drinking Water Act (Part 141, Title 40, Code of Federal Regulations), the facility shall consider the promulgated MCLs as the GWPS, unless the calculated background concentration is higher than the MCL. The facility shall use the most current list of MCLs (promulgated under Part 141). To obtain a copy of the MCLs, please contact Office of Water, U.S. Environmental Protection Agency, Washington, D.C. or call the Safe Drinking Water hotline at 1-800-426-4791 or log on to <http://www.epa.gov/safewater/consumer/pdf/mcl.pdf>.

III. Acceptable ACL

In accordance with 9VAC 20-80-760.B, for calculating the risk based ACL, the facility shall consider the impact to human health and the environment. **The lowest risk based concentration of these two will be the acceptable ACL.**

A. Human Health

In accordance with 9VAC 20-80-760.B.3., for a site with detected carcinogens in the groundwater, the ACL shall not pose an excess cancer risk of 10^{-4} to 10^{-6} . A 10^{-4} risk level equates to one excess cancer occurrence in ten thousand exposed individuals. EPA recommends that approved States use 1×10^{-6} as the point of departure for establishing GWPS. Any departure from the standard (1×10^{-6}) must be supported by the site-specific information to establish the GWPS within the acceptable range.

In accordance with 9VAC 20-80-760.B.4., for a site with single or multiple noncarcinogen contaminants, the ACL will represent a concentration to which a human population could be exposed on a daily basis without appreciable risk of deleterious effects during a lifetime (including sensitive subgroups). The potential risk shall be evaluated using the hazard quotient assumed to be equal to 1 (ratio of chronic daily intake to a reference dose). For sites with multiple contaminants the hazard index shall not exceed 1.

B. Environment

1. For sites with single or multiple detected contaminants in the groundwater where the impacted aquifer discharges to surface waters, the promulgated ecological standards (including the EPA benchmarks) shall be considered when establishing the acceptable ACL at the POC. The surface water standards for aquatic life are provided in 9 VAC 25-260-140 Criteria for Surface Water of the Virginia Water Quality Standards. The most recent update of these standards should be consulted.
2. For sites with single or multiple detected contaminants in the groundwater, and no

promulgated standards, the ACL will be established on a case-by-case basis. The established ACL will be based on the "end points". An end point is the physical or biological parameter characteristic of the ecosystem.

IV. Use of Quantitation Limit as GWPS

If the established GWPS for a chemical is found to be lower than the laboratory specific quantitation limit (QL) for any sampling event, the laboratory QL may be considered as the upper limit for statistical evaluation of data, provided the Department has accepted the QL. Please note that the laboratory QLs may vary with sampling events and a change of analytical methods. The facility should demonstrate that an attempt has been made to achieve the established GWPS and the samples were analyzed in accordance with the approved sampling and analysis plan.

V. Potential use of the groundwater

For the purpose of establishing ACLs, all aquifers shall be evaluated for the potential drinking water use unless otherwise it is demonstrated that the aquifer is not a current or a potential drinking water source. The facility shall submit information on current and future uses of groundwater in the area.

VI. Calculation of ACL

The following procedure shall be considered to establish the ACLs.

For those constituents for which MCLs are not promulgated, the facility may establish the ACL. The facility may consider the risk based alternate concentrations presented in Appendix II, if the assumptions presented with the table meet the site-specific criteria or else calculate a more site-specific ACL using the REAMS program in accordance with Appendix I.

VII. Value of Zero (0.0) in ACL Table

The older versions of ACL table show a value of zero (0.0) in the last column titled "ACL (µg/L)" for some of the constituents. This zero value implies that the toxicity values to calculate ACL were not available from the sources identified in Appendix I; therefore DEQ did not calculate an ACL for these constituents.

VIII. Updates of ACL Table

The ACL table will be updated June and December of every calendar year. Please contact DEQ for the most recent update.

References

1. Environmental Protection Agency (EPA). 1992. RCRA Groundwater Monitoring: Draft Technical Guidance. Office of Solid Waste. Washington, DC: Agency, EPA/600/8-89/043.
2. Environmental Protection Agency (EPA). 1987. Alternate Concentration Limit Guidance. Office of Solid Waste, Waste Management Division. Washington, DC: Agency, EPA/530-SW-87-017.
3. Guidance for development of health based cleanup goal using decision Tree/REAMS. 1994. Virginia Department of Environmental Quality.

APPENDIX I

METHODOLOGY TO CALCULATE ACL USING REAMS WINDOWS VERSION

The Department will accept an ACL developed using REAMS or appropriate risk assessment equations. For more details on REAMS refer to the Document titled "Guidance for Development of Health Based Cleanup Goals using the Decision Tree/REAMS Program" dated November 1, 1994 by Old Dominion University, Norfolk, Virginia.

The following steps must be considered for developing REAMS based ACLs:

Step 1. List all the constituents detected above the background concentrations including those with promulgated MCL (under Section 1412 of the Safe Drinking Water Act (Part 141), Title 40, Code of Federal Regulations).

Step 2. Run REAMS Windows version;

- i) From the Main Menu, select Setup
- ii) On Setup screen add Chemicals of Concern, specify if the chemical is a carcinogen or non-carcinogen and the risk goal (1e-6).
- iii) Click on Media. Select groundwater and enter a default concentration of 100 ppm or more. Select Risk Analysis on bottom of the screen.
- iv) Click on "Perform Risk Analysis".
 - a. For carcinogens, acceptable risk is 1E-4 to 1E-6. DEQ uses 1×10^{-6} as point of departure.
 - b. For non-carcinogens REAMS uses a hazard index of 1 (summation of hazard for multiple chemicals).
 - c. Select residential use, if the aquifer is a current or potential drinking water source.
 - d. Use the slope factors and reference doses from IRIS (Integrated Risk Information System). If a slope factor or reference dose is not available from IRIS, consider the one from the HEAST (Health Effects Assessment Summary Tables). For further guidance on considering slope factors and

reference doses, please refer to Appendix II.

- e. If there is a surface water body on-site between the waste disposal area(s) and the point of compliance, the facility must consider the surface water exposure scenario (consider Virginia Water Quality Standards, Federal Water Quality Criteria, and EPA evaluated ecological benchmarks) and its impact to human health and the environment.
- f. If the facility demonstrates that the current and future exposure is not occurring at the point of compliance, and if the point of exposure is further downgradient of the groundwater sampling location (POC), the AT123D module shall be used to determine the ACL at the point of exposure.

Step 3. For all the constituents for which the MCL(s) are not promulgated, consider the acceptable concentration developed by the model as the GWPS.

Step 4. **At a minimum, in addition to the information required under 9VAC 20-80-760, submit the following to the Department:**

- a. A list of constituents detected above the background for which ACLs are established using REAMS.
- b. A list of constituents for which the MCL(s) are considered as GWPS.
- c. If a fate and transport model was used, please provide a copy of the input and output file and all the data used to run the REAMS with appropriate field and data references.

If you have any questions on the REAMS/guidance, and attached table, or if the above method is not applicable, please call Sanjay V. Thirunagari at (804) 698-4193.

Appendix II

The attached table shall be used only for those sites which meet the following assumptions:

1. The groundwater is a potential drinking water source.
2. The current or future point of exposure is located at the point of compliance and no fate and transport modeling is necessary to establish the ACL.
3. No site specific risk assessment is necessary to evaluate the impact to the groundwater.
4. The target risk level for carcinogens is $1E-6$.
5. The target hazard quotient is 1.
6. Impact to surface water is not significant.
7. Cumulative risk from presence of multiple contaminants is not evaluated.

The following is the basis for the calculated ACLs.

1. Slope factors

For carcinogenic volatile compounds lacking inhalation slope factors, oral slope factors were considered. Similarly for the volatile compounds lacking oral slope factors, inhalation slope values were considered for calculating the risk based concentration level.

2. Reference Doses

For non-carcinogenic volatile compounds lacking inhalation reference doses, oral reference doses were considered. However, inhalation reference doses were considered for all non-carcinogens lacking oral reference doses.

3. Carcinogens exposure scenario

For carcinogenic risk, childhood (0-6 years) and adult exposure were combined for ingestion and inhalation. However, for non-carcinogens the child exposure scenario was considered for ingestion and inhalation. REAMS Windows version uses age adjusted values for carcinogens.